In The Drawings

Please replace informal drawings (FIGURES 1-14) with the proposed amended formal drawings (FIGURES 1-14).

In The Specification

At page 1, line 3 before "Background of Invention" insert the following substitute paragraphs:

RELATED APPLICATION

The present application is a continuation of co-pending U.S. Patent Application Serial No. 09/351,418, titled MODIFICATION OF THE SHAPE/SURFACE FINISH OF BATTERY GRID WIRES TO IMPROVE PAST ADHESION, filed July 9, 1999, which is hereby incorporated by reference.

In The Claims

Please cancel Claims 1-38, without prejudice.

Please add the following new Claims 39-114 as follows:

39. A method of making a battery comprising:

forming a strip of interconnected grids from a grid material, each interconnected grid including a network bordered by at least one frame element, one of the frame elements having a current collector, the network comprising a plurality of spaced apart grid elements, each grid element having opposed ends, each opposed end being joined to one of a plurality of nodes to define a plurality of open spaces in the network;

forming at least a portion of the grid elements at a position intermediate the opposed ends of the grid element such that a first transverse cross-section taken intermediate the opposed ends of the grid element differs from a second transverse cross-section taken at one of the opposed ends of the grid element;

applying paste to the strip; and

cutting the strip to form a plurality of plates.

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1   40.   The method of Claim 39 wherein forming at least a portion of the grid
2   elements comprises:
3   applying a torsional stress to the grid element at the position intermediate
4   the opposed ends of the grid element thereby rotating the grid element.

1   41.   The method of Claim 39 wherein forming at least a portion of the grid
2   elements comprises:
3   applying a torsional stress to the grid wire element at the position
4   intermediate the opposed ends of the grid element thereby rotating the grid
5   element.

1   42.   The method of Claim 39 wherein forming at least a portion of the grid
2   elements comprises:
3   stamping the grid element at the position intermediate the opposed ends
4   of the grid element.

1   43.   The method of Claim 42 wherein the first transverse cross-section
2   substantially has a shape selected from the group comprising diamond, oval, rhomboid,
3   hexagon, and octagon.

1   44.   The method of Claim 43 wherein the network and each of the frames
2   define opposed substantially planar surfaces, and each first transverse cross-section does
3   not extend beyond the planar surfaces.

1   45.   The method of Claim 39 wherein the network and each of the frames
2   define opposed substantially planar surfaces, and each second transverse cross-section
3   does not extend beyond the planar surfaces.

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46. The method of Claim 41 wherein forming the strip of interconnected grids from a grid material comprises:

feeding a continuous strip of the grid material along a linear path aligned with the longitudinal direction of the strip; and

punching grid material out of the strip to form the strip of interconnected grids.

47. The method of Claim 46 wherein the continuous strip of the grid material is formed by a continuous casting process.

48. The method of Claim 46 wherein the continuous strip of the grid material is formed by a rolling process.

49. The method of Claim 41 wherein forming the strip of interconnected grids from a grid material comprises:

feeding a continuous strip of the grid material along a linear path aligned with the longitudinal direction of the strip;

piercing apertures in the strip of grid material; and

laterally expanding the strip of grid material to form the strip of interconnected grids.

50. The method of Claim 41 wherein forming the strip of interconnected grids from a grid material comprises:

melting the grid material;

continuously casting the grid material to from a continuous web; and

rolling the web to form the strip of interconnected grids.

51. The method of Claim 41 wherein forming the strip of interconnected grids from a grid material comprises:

melting the grid material; and

continuously casting the grid material to form the strip of interconnected grids.

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1   52.   The method of Claim 41 further comprising forming at least a portion of

2   the nodes before applying paste to the strip.

1   53.   The method of Claim 39 wherein the grid element is a grid wire.

1   54.   The method of Claim 39 wherein the network is a web.

1   55.   The method of Claim 39 wherein forming the grid comprises deforming

2   the grid.

1   56.   The method of Claim 39 further comprising installing at least one plate in

2   a container.

1   57.   The method of Claim 39 further comprising providing acid in the battery.

1   58.   The method of Claim 39 wherein the collector comprises a lug.

1   59.   A method of making a battery of a type having plurality of grids

2   comprising:

3   forming a strip of interconnected grids from a grid material, each

4   interconnected grid including a network bordered by at least one frame element,

5   one of the frame elements having a current collector, the network comprising a

6   plurality of spaced apart grid elements, each grid element having opposed ends,

7   each opposed end being joined to one of a plurality of nodes to define a plurality

8   of open spaces in the network;

9   forming at least a portion of the grid elements at a position intermediate

10   the opposed ends of the grid element such that a first transverse cross-section

11   taken intermediate the opposed ends of the grid element differs from a second

12   transverse cross-section taken at one of the opposed ends of the grid element;

13   and

14   cutting the strip to form a plurality of grids.

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1   60.   The method of Claim 59 wherein the step of forming at least a portion of
2   the grid elements comprises applying a torsional stress to the grid element at the
3   position intermediate the opposed ends of the grid element thereby rotating the grid
4   element.

1   61.   The method of Claim 59 wherein the step of forming at least a portion of
2   the grid elements comprises stamping the grid element at the position intermediate the
3   opposed ends of the grid element.

1   62.   The method of Claim 61 wherein the network and each of the frames
2   define opposed substantially planar surfaces, and each first transverse cross-section does
3   not extend beyond the planar surfaces.

1   63.   The method of Claim 59 wherein the grid element is a grid wire.

1   64.   The method of Claim 59 wherein the network is a web.

1   65.   The method of Claim 59 further comprising the step of installing at least
2   one plate in a container.

1   66.   The method of Claim 59 further comprising the step of providing acid in
2   the battery.

1   67.   The method of Claim 59 wherein forming the grid comprises deforming
2   the grid.

1   68.   The method of Claim 59 wherein the collector comprises a lug.

69. A method of making a battery of a type having a plurality of battery plates comprising:

    melting a grid material;

    continuously casting the grid material to form a continuous strip;

    rolling the strip;

    punching grid material out of the strip to form interconnected grids, each interconnected grid including a network bordered by a frame, the frame having a current collector lug, the network comprising a plurality of spaced apart grid elements, each grid element having opposed ends, each opposed end being joined to one of a plurality of nodes to define a plurality of open spaces in the network;

    stamping at least a portion of the grid elements at a position intermediate the opposed ends of the grid element such that a first transverse cross-section taken at the position intermediate the opposed ends of the grid element differs from a second transverse cross-section taken at one of the opposed ends of the grid element;

    applying paste to the strip; and

    cutting the strip to form the plurality of battery plates.

70. The method of Claim 69 wherein the first transverse cross-section substantially has a shape selected from group comprising diamond, oval, rhomboid, hexagon, and octagon.

71. The method of Claim 69 wherein the network and each of the frames define opposed substantially planar surfaces, and each first transverse cross-section does not extend beyond the planar surfaces.

72. The method of Claim 69 wherein the grid element is a grid wire.

73. The method of Claim 69 wherein the network is a web.

1   74.   The method of Claim 69 further comprising the step of installing at least
2   one plate in a container.

1   75.   The method of Claim 69 further comprising the step of providing acid in
2   the battery.

1   76.   The method of Claim 69 wherein forming the grid comprises deforming
2   the grid.

1   77.   The method of Claim 69 wherein the collector comprises a lug.

1   78.   A method of forming a battery of a type having a positive plate
2   comprising:
3   casting a material to form a continuous strip;
4   rolling the strip;
5   punching material out of the strip to form interconnected grids, each
6   interconnected grid including a network and a current collector, the network
7   comprising a plurality of spaced apart grid elements, each grid element having
8   opposed ends, each opposed end being joined to one of a plurality of nodes to
9   define a plurality of open spaces in the network;
10   stamping at least a portion of the grid elements at a position intermediate
11   the opposed ends of the grid element such that a first transverse cross-section
12   taken at the position intermediate the opposed ends of the grid element differs
13   from a second transverse cross-section taken at one of the opposed ends of the
14   grid element;
15   applying paste to the strip; and
16   cutting the strip to form a plurality of positive plates.

1   79.   The method of Claim 78 wherein the first transverse cross-section
2   substantially has a shape selected from group comprising diamond, oval, rhomboid,
3   hexagon, and octagon.

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1   80.   The method of Claim 79 wherein the network and each of the frames

2 define opposed substantially planar surfaces, and each first transverse cross-section does

3 not extend beyond the planar surfaces.

1   81. ·   The method of Claim 78 wherein the grid element is a grid wire.

1   82.   The method of Claim 78 wherein the network is a web.

1   83.   The method of Claim 78 further comprising the step of installing at least

2 one plate in a container.

1   84. .   The method of Claim 78 further comprising the step of providing acid in

2 the battery.

1   85.   The method of Claim 78 wherein forming the grid comprises deforming

2 the grid.

1   86.   The method of Claim 78 wherein the collector comprises a lug.

1   87.   A method of making grid for use in a battery comprising:

2   forming a preform grid, the preform grid including a network bordered

3 by at least one frame element, one of the frame elements having a current

4 collector, the network comprising a plurality of spaced apart grid elements, each

5 grid element having opposed ends, each opposed end being joined to one of a

6 plurality of nodes to define a plurality of open spaces in the network; and

7   forming at least a portion of the grid elements of the preform grid at a

8 position intermediate the opposed ends of the grid element such that a first

9 transverse cross-section taken at the position intermediate the opposed ends of

10 the grid element differs from a second transverse cross-section taken at one of

11 the opposed ends of the grid element.

1   88.   The method of Claim 86 wherein the first transverse cross-section
2   substantially has a shape selected from group comprising diamond, oval, rhomboid,
3   hexagon, and octagon.

1   89.   The method of Claim 86 wherein the network and each of the frames
2   define opposed substantially planar surfaces, and each first transverse cross-section does
3   not extend beyond the planar surfaces.

1   90.   The method of Claim 87 wherein the grid element is a grid wire.

1   91.   The method of Claim 87 wherein the network is a web.

1   92.   The method of Claim 87 further comprising the step of installing at least
2   one plate in a container.

1   93.   The method of Claim 87 comprising the step of providing acid in the
2   battery.

1   94.   The method of Claim 87 wherein forming the grid comprises deforming
2   the grid.

1   95.   The method of Claim 87 wherein the collector comprises a lug.

1   96.   A grid for a battery comprising a network bordered by at least one frame
2   element, one of the frame elements having a current collector,
3   the network comprising a plurality of spaced apart grid elements, each
4   grid element having opposed ends, each opposed end being joined to one of a
5   plurality of nodes to define a plurality of open spaces,
6   at least a portion of the grid elements having a first transverse cross-
7   section taken at a position intermediate the opposed ends of the gird element that
8   differs from a second transverse cross-section taken at one of the opposed ends
9   of the grid element.

1   97.   The grid of Claim 96 wherein the second transverse cross-section is
2   substantially rectangular.

1   98.   The grid of Claim 96 wherein the first transverse cross-section is a
2   substantially rectangular cross-section rotated about 20 degrees to about 70 degrees in
3   relation to the second transverse cross-section.

1   99.   The grid of Claim 96 wherein the first transverse cross-section is a
2   substantially rectangular cross-section rotated about 35 degrees to about 55 degrees in
3   relation to the second transverse cross-section.

1   100.   The grid of Claim 96 wherein the first transverse cross-section
2   substantially has a shape selected from group consisting generally of diamond, oval,
3   rhomboid, hexagon, and octagon.

1   101.   The grid of Claim 96 wherein the network provides a frame and each of
2   the frames define opposed substantially planar surfaces, such that each first transverse
3   cross-section does not extend beyond the planar surfaces.

1   102.   The grid of Claim 101 wherein the first transverse cross-section is
2   substantially a diamond shape.

1   103.   The grid of Claim 101 wherein the first transverse cross-section is
2   substantially a hexagon shape.

1   104.   The grid of Claim 101 wherein the first transverse cross-section is
2   substantially an octagon shape.

1   105.   The grid of Claim 101 wherein the first transverse cross-section is
2   substantially an oval shape.

1   106.   The grid of Claim 101 wherein the first transverse cross-section is
2   substantially a rhomboid shape.

1   107.   The grid of Claim 96 wherein the grid element is a grid wire.

1   108.   The grid of Claim 96 wherein the network is a web.

1   109.   The grid of Claim 96 further comprising a container.

1   110.   The grid of Claim 96 wherein the collector comprises a lug.

1   ~~111.~~   A battery comprising:

2   a frame;

3   at least one grid comprising a first frame member spaced apart from a

4   second frame member;

5   wherein the first frame member has a first transverse cross-section and

6   the second frame member has a second transverse cross-section area.

1   112.   The battery of Claim 111 wherein the frame defines a plane and the first

2   and second transverse cross-section areas do not substantially intersect the plane.

1   113.   The battery of Claim 112 further comprising a paste coupled to the grid.

1   114.   The battery of Claim 113 further comprising a container.